ARPA Network Information Center
Stanford Research Institute
Menlo Park, California 94025

20120

COMPUTER CORPORATION OF AMERICA

Postel

RFC: 415
NIC: 10428

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FROM: HAL MURRAY

SUBJECT: TENEX BANDWIDTH
REF: RFC 392 (NIC 11584)

DATE: 29-NOV-72

NIC 11584 (RFC 392) BY G. HICKS AND B. WESSLER AT UTAH RECENTLY DISCUSSED THE COST OF USING THE NETWORK.

I WOULD LIKE TO TAKE THESE SAME TYPES OF NUMBERS AND LOOK AT 'EM FROM ANOTHER POINT OF VIEW. WITHOUT CALCULATING COSTS, LET US CONSIDER ULTIMATE PERFORMANCE OF THE HOSTS. I WROTE A SIMPLE TENEX PROGRAM THAT SENT ITSELF STRINGS OVER THE NET. IT USED BIN/BOUT AND THE BUFFERED SEND MODE. IT COUNTED THINGS, BUT DID NOT PROCESS THE STRING. WITH SAMPLES OF A MILLION BITS, THE FOLLOWING RESULTS WERE OBTAINED.

BYTES/SIZE	REAL BAUD	CPU BAUD	CPU NEEDED
50/36	48.8K	291K	16%
100/36	46.5K	309K	15%
200/36	52.7K	322K	16%
400/36	59.3K	267K	22%
800/36	61.1K	279K	21%
50/8	22.0K	70K	31%
100/8	26.7K	76K	35%
200/8	29.0K	79K	36%
400/8	30.0K	81K	37%
800/8	31.9K	78K	40%
1600/8	38.1K	64K	59%
3200/8	41.8K	59K	70%

THE FOLLOWING WERE OBTAINED USING SIN/SOUT WITHOUT THE BUFFERED MODE.

BYTES/SIZE	REAL BAUD	CPU BAUD	CPU NEEDED
50/36	36K	95K	38%
100/36	44K	95K	45%
200/36	49K	92K	53%
400/36	54K	90K	60%
50/8	12K	22K	57%
100/8	16K	21K	75%
200/8	18K	20K	92%
400/8	20K	20K	99%

THESE TESTS WERE RUN WITH NO OTHER LOAD ON OUR SYSTEM, AN EARLY VERSION OF 1.29. THE INPUT AND OUTPUT HALVES OF THE TRANSMISSION HAVE BEEN AVERAGED TOGETHER. I.E. THE ABOVE BAUD RATES WERE CALCULATED USING 2 MILLION BITS SINCE THE STRINGS WENT OUT AND IN.

OTHER PIECES OF DATA:

OUR TTY'S AND LPT HAVE ULTIMATE CPU BANDWIDTHS NEAR 15-20 KB. AT 2400 BAUD, A TTY TAKES 15% OF THE CPU. TELNETS NESTED THREE DEEP ARE ALMOST COMPUTE LIMITED WHEN JUST TYPING THINGS OUT ON A 2400 BAUD TERMINAL.

AS A ROUGH CALCULATION, THE BANDWIDTH OF THE TIP TAPE TRANSMISSION FEATURE - USING STEVE BUTTERFIELD'S (OF BBN) NETMAG PROGRAM - IS ABOUT 7 KILOBITS/SEC. ONE TAPE OF ABOUT 6,000 TENEX PAGES TOOK ABOUT 4 HOURS TO TRANSMIT. THIS WAS A FULL TAPE FROM ETAC TO CCA LATE ONE NIGHT WITH NOTHING ELSE RUNNING ON OUR SYSTEM. ABOUT 30% OF THE CPU IS NEEDED TO MAINTAIN THIS BANDWIDTH. AGAIN THIS IS ONLY ABOUT 20KB PER CPU SEC.